

CLAIMS

1. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:
 - a plurality of longitudinal rovings oriented along the longitudinal axis of the part;
 - a reinforcing structure comprising a permeable transport web of staple fibers ~~attached to~~ bonded to a plurality of first reinforcing fibers oriented so that the portion of the first reinforcing fibers oriented in a transverse direction to the longitudinal rovings comprises at least 40% of a volume of materials comprising the reinforcing structure; and
 - a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.
2. (Currently Amended) The pultruded part of claim 1 wherein the portion of the ~~first~~ reinforcing fibers oriented in the transverse direction comprises at least 50% of a volume of materials comprising the reinforcing structure.
3. (Currently Amended) The pultruded part of claim 1 wherein the ~~first~~ reinforcing fibers comprise one or more overlapping layers of ~~first~~ reinforcing fibers.
4. (Currently Amended) The pultruded part of claim 1 wherein the staple fibers comprise a length of about $\frac{1}{2}$ ~~inch to about~~ 4 inches.
5. (Currently Amended) The pultruded part of claim 1 wherein the staple fibers comprise a length of about 0.01 ~~inch to about~~ 12 inches.
6. (Original) The pultruded part of claim 1 wherein the permeable transport web comprises heat-fusible fibers.

7. (Original) The pultruded part of claim 1 wherein the permeable transport web comprises at least two different polymeric fibers each comprising a different glass transition temperature.

8. (Original) The pultruded part of claim 7 wherein the at least two polymeric fibers comprise a glass transition temperature of about 350 °F and about 270 °F, respectively.

9. (Original) The pultruded part of claim 1 wherein the permeable transport web comprises:

a plurality of first polymeric fibers comprising a first glass transition temperature; and

a plurality of bi-component fiber wherein a first component comprises the first glass transition temperature and a second component comprises a second glass transition temperature less than the first glass transition temperature.

10. (Original) The pultruded part of claim 9 wherein the bi-component fibers comprise a core-sheath configuration.

11. (Original) The pultruded part of claim 1 wherein the permeable transport web comprises in-plane mechanical and directional stability.

12. (Currently Amended) The pultruded part of claim 1 wherein the permeable transport web comprises a plurality of fibers at least a portion of which are randomly entangled with the ~~first~~ reinforcing fibers.

13. (Currently Amended) The pultruded part of claim 1 wherein the permeable transport web comprises a plurality of fibers at least a portion of which are thermally bonded with the ~~first~~ reinforcing fibers.

14. (Currently Amended) The pultruded part of claim 1 wherein the ~~first~~ reinforcing fibers are spaced apart and attached ~~together~~ to the permeable transport web by a continuous stitching fibers.

15. (Currently Amended) The pultruded part of claim 14 wherein the stitching fiber comprises glass fibers; natural fibers; carbon fibers; metal fibers; ceramic fibers; synthetic or polymeric fibers; composite fibers (including one or more components of glass, natural materials, metal, ceramic, carbon, ~~and/or~~ synthetics components); or a combination thereof.

16. (Currently Amended) The pultruded part of claim 1 comprising a binder ~~attaching~~ bonding the permeable transport web to the ~~first~~ reinforcing fibers.

17. (Currently Amended) The pultruded part of claim 16 wherein the binder comprises one or more of a ~~specialized-latex binder diluted in a water carrier~~, a polyvinyl acetate emulsion, ~~and/or~~ a crosslinking polyvinyl acetate emulsion.

18. (Currently Amended) The pultruded part of claim 1 comprising a plurality of perforations through the permeable transport web and extending between the ~~first~~ reinforcing fibers containing resin.

19. (Original) The pultruded part of claim 1 wherein the reinforcing structure comprises a permeability of at least $180 \text{ ft}^3/\text{minute}/\text{ft}^2$ as measured according to the procedure of ASTM D737-96 with a pressure differential of about 0.5 inch column of water.

20. (Original) The pultruded part of claim 1 wherein the reinforcing structure comprises a permeability of about $300 \text{ ft}^3/\text{minute}/\text{ft}^2$ as measured according to the procedure of ASTM D737-96 with a pressure differential of about 0.5 inch column of water.

21. (Original) The pultruded part of claim 1 wherein the reinforcing structure comprises a permeability of more than $350 \text{ ft}^3/\text{minute}/\text{ft}^2$ as measured according to the procedure of ASTM D737-96 with a pressure differential of about 0.5 inch column of water.

22. (Original) The pultruded part of claim 1 wherein the reinforcing structure comprises a circular bending stiffness of at least about 4 Newtons as measured according to the procedure of ASTM D4032-94.

23. (Original) The pultruded part of claim 1 wherein the reinforcing structure comprises a circular bending stiffness in a range of at least about 4 Newtons to about 15 Newtons as measured according to the procedure of ASTM D4032-94.

24. (Currently Amended) The pultruded part of claim 1 wherein the reinforcing structure comprises a thickness of about 0.004 ~~inches to about~~ 0.020 inches.

25. (Currently Amended) The pultruded part of claim 1 wherein the reinforcing structure comprises a thickness of about 0.010 ~~inches to about~~ 0.012 inches.

26. (Original) The reinforcement structure of claim 1 wherein the reinforcement structure comprises a tensile strength in the transverse direction of about 200 lbs/inch as measured using the procedure of ASTM D76-99.

27. (Previously Presented) The reinforcement structure of claim 1 wherein the reinforcement structure comprises a tensile strength in a pull direction of at least 6 lbs/inch as measured using the procedure of ASTM D76-99.

28. (Currently Amended) The pultruded part of claim 1 wherein the ~~first~~ reinforcing fibers comprise glass fibers; natural fibers; carbon fibers; metal fibers; ceramic fibers; synthetic or polymeric fibers; composite fibers (including one or more components of glass, natural materials, metal, ceramic, carbon, ~~and/or synthetics components~~); or a combination thereof.

29. (Currently Amended) The pultruded part of claim 1 wherein the ~~first~~ reinforcing fibers comprise at least one polymeric component.

30. (Currently Amended) The pultruded part of claim 1 wherein the ~~first~~ reinforcing fibers comprise a surface ~~treatment including~~ treated with an organosilane agent.

31. (Currently Amended) The reinforcement structure of claim 30 wherein the organosilane agent comprises one or more families of a cationic amino-functional silane, ~~Tristris~~ (2- methoxyethoxyvinylsilane), or 3-methacryloxypropyltrimethoxysilane.

32. (Previously Presented) The pultruded part of claim 1 wherein the transverse direction comprises a direction about $90^{\circ} \pm 10^{\circ}$ relative to a pull direction.

33. (Previously Presented) The pultruded part of claim 1 wherein the transverse direction comprises a direction about $90^{\circ} \pm 5^{\circ}$ relative to a pull direction.

34. (Currently Amended) The pultruded part of claim 1 wherein substantially all of the ~~first~~ reinforcing fibers extend continuously across a width of the reinforcing structure.

35. (Currently Amended) The pultruded part of claim 1 comprising a plurality of permeable transport webs ~~attached~~ bonded to the ~~first~~ reinforcing fibers.

36. (Currently Amended) The pultruded part of claim 1 wherein the reinforcing structure comprises at least a plurality of first and second reinforcing fibers extending at one or more acute angles relative to a pull direction.

37. (Currently Amended) The pultruded part of claim 1 wherein the reinforcing structure comprises at least a plurality of first and second reinforcing fibers extending at a first acute angle relative to a pull direction and a plurality of third reinforcing fibers extending at a second acute angle that is the negative of the first acute angle.

38. (Previously Presented) The pultruded part of claim 37 comprising a plurality of fourth reinforcing fibers extending in a pull direction.

39. (Original) The pultruded part of claim 37 wherein the first reinforcing fibers are located between the second and third reinforcing fibers.

40. (Currently Amended) The pultruded part of claim 1 wherein the reinforcing structure comprises at least a plurality of first and second reinforcing fibers extending at a first acute angle relative to a pull direction, a plurality of third reinforcing fibers extending at a second acute angle that is the negative of the first acute angle, and a plurality of fourth reinforcing fibers extending generally in the pull direction.

41. (Currently Amended) The pultruded part of claim 40 wherein the permeable transport web comprises a plurality of fibers at least a portion of which are randomly entangled and bonded with one or more of the first, second, third or fourth reinforcing fibers.

42. (Original) The pultruded part of claim 40 wherein the permeable transport web comprises a plurality of fibers at least a portion of which are thermally bonded with one or more of the first, second, third or fourth reinforcing fibers.

43. (Original) The pultruded part of claim 40 wherein the first reinforcing fibers are stitched with one or more of the permeable transport web, the second reinforcing fibers, the third reinforcing fibers, and the fourth reinforcing fibers.

44. (Currently Amended) The pultruded part of claim 40 comprising a binder ~~attaching~~bonding the permeable transport web to one or more of the first, second, third or fourth reinforcing fibers.

45. (Original) The pultruded part of claim 40 wherein one or more of the first, second, third or fourth reinforcing fibers comprise a polymeric component.

46. (Original) The pultruded part of claim 40 wherein the first reinforcing fibers are located between the second and third reinforcing fibers and the fourth reinforcing fibers.

47. (Original) The pultruded part of claim 40 wherein the first, second, third or fourth reinforcing fibers comprise discrete layers.

48. (Currently Amended) The pultruded part of claim 1 wherein the longitudinal rovings comprise glass fibers;_; natural fibers;_; carbon fibers;_; metal fibers;_; ceramic fibers;_; synthetic or polymeric fibers;_; composite fibers including one or more components of glass, natural materials, metal, ceramic, carbon, ~~and~~/or synthetics components;_; or a combination thereof.

49. (Currently Amended) The pultruded part of claim 1 wherein the pultruded part comprises a wall thickness of about 0.045 ~~inches to about~~ 0.025 inches.

50. (Original) The pultruded part of claim 1 wherein the pultruded part comprises a wall thickness of about 0.039 inches or less.

51. (Original) The pultruded part of claim 1 wherein the longitudinal rovings and the reinforcing structure comprise alternating layers.

52. (Original) The pultruded part of claim 1 wherein the reinforcing structure is located adjacent to an outer surface of the pultruded part.

53. (Original) The pultruded part of claim 1 wherein the longitudinal rovings are located adjacent to an outer surface of the pultruded part.

54. (Original) The pultruded part of claim 1 comprising a plurality of longitudinal rovings adjacent to both surfaces of the reinforcing structure.

55. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a plurality of first reinforcing fibers generally oriented in a transverse direction ~~attached to a permeable transport web~~, the longitudinal rovings ;

~~_____~~ a permeably transport web bonded to the reinforcing fibers comprising a plurality of first polymeric fibers comprising a first glass transition temperature and a plurality of bi-component fiber wherein a first component comprises the first glass transition temperature and a second component comprises a second glass transition temperature less than the first glass transition temperature; and

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

56. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a plurality of first reinforcing fibers oriented in a transverse direction relative to the longitudinal axis thermally bonded to a permeable transport web of staple fibers so that the reinforcing structure comprises a permeability of at least $180 \text{ ft}^3/\text{minute}/\text{ft}^2$ as measured according to the procedure of ASTM D737-96 with a pressure differential of about 0.5 inch column of water; and

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

57. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a reinforcing structure of a plurality of first reinforcing fibers oriented in a transverse direction ~~attached to the longitudinal rovings and bonded~~ to a permeable transport web of staple fibers such that a ratio of a modulus of elasticity of the reinforcing structure in the transverse direction relative to a modulus of elasticity in a pull direction comprises at least 1.2; and

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

58. (Previously Presented) The reinforcing structure of claim 57 wherein the ratio of the modulus of elasticity of the reinforcing structure in the transverse direction relative to the modulus of elasticity in a pull direction comprises at least 1.5.

59. (Previously Presented) The reinforcing structure of claim 57 wherein the ratio of the modulus of elasticity of the reinforcing structure in the transverse direction relative to the modulus of elasticity in a pull direction comprises at least 3.

60. (Previously Presented) The reinforcing structure of claim 57 wherein the ratio of the modulus of elasticity of the reinforcing structure in the transverse direction relative to the modulus of elasticity in a pull direction comprises at least 5.

61. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a plurality of non-overlapping ~~first~~ reinforcing fibers ~~attached~~ bonded to a permeable transport web of staple fibers such that the portion of the ~~first~~ reinforcing fibers extending in a transverse direction comprises at least 30% of a volume of materials comprising the reinforcing structure; and

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

62. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a reinforcing structure comprising a plurality of ~~first~~ reinforcing fibers oriented at 45° (+/- 15°) relative to a pull direction, a plurality of second reinforcing fibers oriented at -45° (+/- 15°) relative to the pull direction, and a permeable transport web of staple fibers ~~attached~~ bonded to the first and second reinforcing fibers such that the first and second

reinforcing fibers comprises at least 30% of a volume of materials comprising the reinforcing structure;

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

63. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings extending along the longitudinal axis of the part;

a reinforcing structure comprising a plurality of ~~first~~ reinforcing fibers oriented at 60° (+/- 15°) relative to a pull direction, a plurality of second reinforcing fibers oriented at -60° (+/- 15°) relative to the pull direction, and a permeable transport web of staple fibers ~~attached~~bonded to the first and second reinforcing fibers such that the first and second reinforcing fibers comprises at least 30% of a volume of materials comprising the reinforcing structure;

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

64. (Currently Amended) A molded part having a uniform cross-section and a longitudinal axis, the molded part comprising:

a reinforcing structure comprising a permeable transport web of staple fibers ~~attached~~bonded to a plurality of ~~first~~ reinforcing fibers oriented so that the portion of the ~~first~~ reinforcing fibers oriented in a transverse direction comprises at least 40% of a volume of materials comprising the reinforcing structure; and

a cured resin matrix substantially surrounding the reinforcing structure.

65. (Currently Amended) A pultruded part having a uniform cross-section and a longitudinal axis, the pultruded part comprising:

a plurality of longitudinal rovings oriented along the longitudinal axis of the part;

a reinforcing structure comprising a permeable transport web of staple fibers ~~attached~~ bonded to a plurality of ~~first~~ reinforcing fibers oriented in a transverse direction continuously across a width of the reinforcing structure; and

a cured resin matrix substantially surrounding the longitudinal rovings and the reinforcing structure.

66. (Currently Amended) A pultruded part formed by pulling in a longitudinal direction through the die to form a part of predetermined transverse cross sectional shape comprising:

reinforcing fibers extending in ~~the~~ a longitudinal direction of the part;

a reinforcement mat having a length extending in the longitudinally of the ~~pultruded~~ part, a width extending across at least a part of the transverse cross-sectional shape and a thickness at right angles to the length and width, the mat comprising elongated reinforcing fibers oriented in a ~~first~~ direction transverse to the longitudinal direction of the part, transport components ~~thereof~~ arranged to provide longitudinal strength, shear strength and anti-skewing resistance sufficient to allow the reinforcing mat to be carried through the pultrusion die with the reinforcing fibers, and ~~entangling~~ fibers defined by at least portions of staple fibers that extend through at least a portion of the thickness, the staple fiber portions being entangled and bonded with the reinforcing fibers; and

a cured, synthetic resin composition ~~enveloping~~ surrounding the reinforcement mat and the reinforcing fibers and configured by the die to define the predetermined transverse cross-sectional shape of the part.